TECHNICAL REVIEW OF THE DRAFT FINAL PHASE III RFI/RI REPORT FOR OPERABLE UNIT 1

ROCKY FLATS PLANT
JEFFERSON COUNTY, COLORADO

Prepared for

U S ENVIRONMENTAL PROTECTION AGENCY
Region 8 Federal Facilities Remedial Branch
Denver Colorado

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INDIVIDUAL IHSSs	
IHSS 102	IHSS 102
Install the following	
• 2 boreholes within IHSS boundary (BH01 and BH02)	• **Installed BH01 and 02 (36491* & 37391) but BH01 not located with IHSS boundary**
• Colluvial monitor well near BH01 (MW01)	• **Did not complete MW01 (36491)**
• 5 boreholes in stained area south of IHSS (BH03 BH07)	• **Installed BH03-07 (31591 31891 31091 30291 30891) and 2 additional BH near BH05 proposed location**
• Colluvial monitor well near BH04 (MW02)	• Installed MW02 (31891)
• 2 boreholes and 2 alluvial wells south and southwest of former pond (BH08 & 09 MW36 & 03)	• **Installed BH08 & 09 (30791 & 30691) and MW36 Did not complete MW03**
IHSS 103	IHSS 103
Install the following	
• 3 boreholes within IHSS (BH10 12)	• Installed BH 10 11 & 12 (36991 36891 36791)
• Colluvial monitor well near BH10 and at another to be determined location (MW04 & 05)	• Completed MW04 & 05 (36991 36191)
IHSS 104	IHSS 104
• Install 2 boreholes within IHSS (BH13 & 14)	• Installed BH13 & 14 (36591 37091)
IHSS 105.1 & 105.2	IHSS 105.5 & 105.2
• Install 2 boreholes adjacent to IHSS & 2 boreholes downgradient of IHSS (BH15 18)	• **Did not install BH15**
	• **Installed BH16 17 & 18 (32191 32491 32091) but BH17 is located near IHSS 106 and not downgradient of IHSS 105 2 as originally proposed**
IHSS 106	IHSS 106
• Install 2 boreholes beneath outfall and check outfall for discharge (BH19 & 20)	• Installed BH19 & 20 (35191 37291)
• Install colluvial monitor well near BH19 (MW06)	• **Did not complete MW06 (35191)**

* These 5 digit numbers correspond to the DOE numbering designation for boreholes and monitoring wells used in the phase III RFI/RI report
Items in bold delineate deviations from proposed activities

ROCKY FLATS OU1 PROPOSED FIELD ACTIVITIES COMPARED TO ACTUAL FIELD ACTIVITIES

FIELD ACTIVITIES PROPOSED IN WORK PLAN OR TECHNICAL MEMORANDUM 5	ACTUAL FIELD ACTIVITIES
French Drain Area Install 4 boreholes downgradient of french drain to assess extent of toluene contamination (BH51 54)	**French Drain Area** Installed 5 boreholes (30591 30491 30391 30191 30091)
NON IHSS SPECIFIC INVESTIGATION Install the following • A bedrock well next to alluvial well wherever sandstone is encountered • 4 alluvial wells upgradient of 881 Hillside (MW20 23) • 4 alluvial wells and 3 bedrock wells downgradient of IHSS 119 1 (MW24 30) • 3 colluvial wells near South Interceptor Ditch (MW31 33) • 3 alluvial wells along Woman Creek downgradient of 881 Hillside (MW34 35 & 37) • Perform 3 pumping and tracer tests each in an array of 15 well points • Install 3 piezometers • Install 3 pilot holes	**NON IHSS SPECIFIC INVESTIGATION** • Two bedrock wells were completed • Completed MW20 23 abandoned MW20 offset location (38091 37791 37591 37691) • Installed MW24 29 & 30 did not install MW26 (32591 37991 31491) and abandoned MW25, 27 & 28 (32791 33391 33091) • Installed but did not complete MW31 33 (31391 31191 30791) • Installed MW 34 35 & 37 but did not complete MW37 (38591 30991 38691) • Two multiple-well test locations canceled • Installed 5 piezometers • Installed 3 pilot holes
SUMMARY	
Install a total of 54 boreholes Install a total of 37 monitor wells 34 alluvial or colluvial wells 3 bedrock wells	• Installed 55 boreholes did not install boreholes at 2 originally proposed locations Installed 3 additional wells at 2 original locations • Completed 26 wells did not complete wells at 11 originally proposed locations 23 alluvial/colluvial wells 3 bedrock wells
SUBSURFACE SOIL ANALYSES	
• Each 6 foot composite sample will be analyzed for SVOCs pesticides PCBs radionuclides metals and inorganic parameters • VOC samples will be collected at discrete depths within the borehole	• It was impossible to determine whether these analyses were done because of the inconsistencies noted between tables figures and field borelogs • VOC samples were collected using a stainless steel sleeve at discrete depths in the borehole

FIELD ACTIVITIES PROPOSED IN WORK PLAN OR TECHNICAL MEMORANDUM 5	ACTUAL FIELD ACTIVITIES
SUBSURFACE SOIL ANALYSIS (continued)	
• Only VOC samples will be collected from subsurface soil samples at monitoring well piezometer and pilot hole locations	• The inconsistencies in the data made this difficult to check However it appears that more than VOC analyses was conducted at some of these locations
• Collect geotechnical samples from 10 locations Samples will be taken from three discrete locations with the borehole	• Geotechnical samples were collected from 11 locations The field boreholes indicate that the samples were not always collected at three discrete intervals
• Collect a sample for TOC analysis from 10 locations Samples will be taken from a 6 foot composite at three intervals within the borehole	• TOC samples were collected at 11 locations The field borelog did not indicate collection of TOC samples
• A radiological screening sample will be collected from each composite sample	• No data was provided to substantiate collection of radiological samples
SURFACE SOIL INVESTIGATION	
• Collect nine samples from 50 x100 plots in Rock Creek drainage using modified Rocky Flats soil sampling technique described in Technical Memo 5	• All samples taken as proposed
• Collect 28 samples from 24 randomly located 50 x100 plots in OU1 plus 4 50 x100 plots in IHSSs 106 130 119 1 and 119 2	• 27 samples collected as proposed One sample in IHSS 130 not collected
• <u>Analyses</u> Analyze surface soil samples for total metals radionuclides SVOCs (base/neutrals) pesticides/PCBs & other parameters	• These analyses were conducted
GROUND WATER INVESTIGATION	
• <u>Analyses</u> Ground water samples will be collected on a quarterly basis and analyzed for metals radionuclides VOCs SVOCs pesticides and PCBs Parameter list may be modified in subsequent sampling rounds The parameter list may be reduced in subsequent quarterly sampling events if certain parameter groups are not detected or are not significantly above background levels and if approved by EPA and CDH	• Analyses Ground water samples were collected on quarterly basis and analyzed for VOCs SVOCs pesticides, PCBs metals and radionuclides The list of compounds proposed in the work plan for the above listed parameters was expanded Some wells which showed non detects during the fourth quarter 1991 ground water sampling were not resampled during the first quarter 1992 No explanation was given for the decision not to resample

FIELD ACTIVITIES PROPOSED IN WORK PLAN OR TECHNICAL MEMORANDUM 5	ACTUAL FIELD ACTIVITIES
AIR INVESTIGATION	
• Place low flow air samples in 4 locations in the Woman Creek drainage on stakes in breathing zone level	• Installed 4 high volume air samplers
• Collect samples for 8 hours and analyze for total suspended particulates and respirable particle fraction	• Samples analyzed for these parameters and plutonium
SURFACE WATER INVESTIGATION	
• Sample 17 existing surface water stations	• Sampled nine locations in 4th quarter 1991
• Analyses Surface water samples will be analyzed for total metals field parameters indicator parameters anions radionuclides VOCs	• Surface water samples were analyzed for these parameters
SEDIMENT INVESTIGATION	
• Sample 3 new sediment stations	• Three new sediments locations sampled
• Physical characteristics of the sediments and the spatial distribution of metal concentrations will be examined to assess the adequacy of the background sediment geochemical characterization and whether metals are contaminants in the 881 Hillside	• This was not done Only data from the new sediment locations were presented No background sediment concentrations were established
• Analyses Analyze sediments for Radionuclides metals SVOCs VOCs pesticides/PCBs indicator parameters	• Sediment samples were analyzed for all these parameters except radionuclides

3 0 GENERAL COMMENTS

The following comments describe the general technical inadequacies and inconsistencies noted in the RFI/RI report. Rather than include every specific inconsistency noted PRC has cited a few examples within the appropriate general comments These examples help to clarify how the document should be revised For ease in reading the general comments have also been subdivided according to the various sections of the RFI/RI. Because the appendices contain data as well as the text of the environmental evaluation (EE) and public health evaluation (PHE) these comments are also subdivided by appendix number It should also be noted that the PHE was divided into chapters and that both the EE & PHE contain attachments Therefore the chapter or attachment number is referenced where appropriate

Section 2 0 OU 1 Field Investigation

1 Geotechnical and total organic carbon (TOC) samples were collected from soil borings In addition borehole geophysical studies were also conducted at five boreholes Although the data generated from these samples and the natural gamma and caliper logs are contained in Appendix A none of the data are discussed in detail in the RFI/RI report. The only reference to the data is contained in the fate and transport section A discussion of this data should be added to the section on nature and extent of contamination discussion (Section 4 0) and/or to the section on physical characteristics (Section 3 0)

Section 3 0, Physical Characteristics of OU 1

1 The RFI/RI report repeatedly assumes that the french drain will capture all contaminated ground water released from OU 1 However data are not provided to support this argument because the monitoring wells that will supply this data were not installed until August 1992 In March 1992 EPA and Colorado Department of Health (CDH) requested that DOE develop and implement a monitoring plan specifically to monitor the ability of the french drain to capture all contaminated ground water in the upper HSU of OU 1 The result of this request was the French Drain Performance Monitoring Plan (FDPMP) by DOE/EG&G in June 1992 (EG&G 1992) Installation of the wells proposed in the FDPMP did not begin until August 1992 Therefore the data needed to assess the performance of the french drain will not be

available until after wet-season (April through June) water levels have been measured in the 13 new monitoring wells which are located directly downslope of the french drain.

Although appropriate data could not be collected in time for this report the Phase III RFI/RI should (1) use whatever weekly water level data are available from these wells at the time this report is compiled (the FDPMP requires water levels to be measured at these wells on a weekly basis throughout the duration of the Interim Measure/Interim Remedial Action [IM/IRA]) and (2) refrain from drawing conclusions about the effectiveness of the french drain in intercepting contaminated ground water in the upper HSU of OU 1 without presentation of adequate monitoring data.

Section 4 0. Nature and Extent of Contamination

1 Numerous inconsistencies were noted involving the text, tables and figures of this RFI/RI report. Most of these inconsistencies were noted in the discussion of contaminant results in Section 4 0 and in the presentation of data in the appendices Specifically PRC was unable to correlate the borelog notations of sample collection (Appendix A) the soil contaminant distribution maps (Section 4 0) the soil samples collected summary table (Table A1-6) the analytes detected tables (Tables 4-7 through 4-15) and the nature and extent discussion (Section 4 0) Inconsistencies were found each time PRC attempted to trace a detected contaminant through all of the above places it was referenced For example the contaminant distribution map indicates that no sample had been collected but the text, Table A1-6 and the data show sample results Because so many inconsistencies were noted the validity of the presented data is suspect.

2 The presentation of data in Section 4 0 made it difficult to verify contaminant concentrations The data summary tables were only brief summaries of the analytes detected Specifically the tables listed types of compounds the sample size number of detections concentration range and concentration mean. They did not include the concentration of a contaminant at depth within the borehole Because the individual data were not presented it was difficult to evaluate the contaminant distribution maps except by reviewing the raw data presented in the appendices To facilitate data review and interpretation the raw data should be reduced to summary tables that clearly illustrate the contaminant concentrations

3 The discussions of IHSS contamination discuss in detail only those contaminants detected at more than an order of magnitude above background levels Other unsupported assumptions about contamination are described below

- The RFI/RI often refers to radionuclide concentrations less than three times background and metal concentrations less than two times background as a reflection of the natural variations of background contaminant levels This is not consistent with the definition of background as developed in the Background Report.

- The background level for organics is set at the detection limit. However the report also states that organics must also be more than an order of magnitude above detection limits in order to be considered a contaminant. The order of magnitude above detection limits approach for organics is also not consistent with the background definition referred to above

- The sediment data were compared to results obtained at an upgradient sediment sampling station. However the RFI/RI also states that this procedure has been discontinued because a RFP sitewide surface water and sediment geochemical background level has been established The RFI/RI report must indicate whether this change in the background level affects the results presented in the report.

As a result of these above-referenced assumptions the discussion on the nature and extent of contamination includes only those data an order of magnitude above background levels The remaining data are limited and often do not provide enough information to establish trends or draw conclusions regarding the contamination. It would be more appropriate to discuss all the collected data in this section. Tables of data for each IHSS would more clearly indicate any trends or patterns in contamination. In addition an explanation for all the assumptions made must be provided

4 The discussion of the nature and extent of contamination does not include the data gathered during the Phase I and II investigations To present a complete overview of the contamination present in OU 1 media, all available data must be used Because areas of noted contamination may not have been resampled during the Phase III investigation it is even more important to use a combined data set Therefore it is recommended that Section 4 0 be rewritten using all valid Phase I II and III data In this manner contaminant trends over time may also be apparent

5 Historical data invaluable to characterizing hydrogeologic conditions and the nature and extent of contamination in the ground water at OU 1 were not provided in this report. The contaminant distribution maps that are provided (Figures 4-94 through 4-97) are inadequate because they represent only low water table conditions (first and fourth quarters) Because the upper HSU is variably saturated throughout the year data were not available for many of the downgradient wells that were dry during the winter However data should be available from Phase I and II monitoring wells during the second and third quarters of previous years (particularly 1990 and 1991) and should be presented to evaluate the extent of contamination during periods when flow occurs in these downgradient areas The presentation of multiple years of data also may illustrate trends in the movement of contaminants

The presentation of water table maps (particularly second quarter) from earlier years would help to evaluate the effectiveness of the french drain The only wet season water table map presented in the Phase III RFI/RI report is from April 1992 after the installation of the french drain The water levels for the January 1992 water table map were measured during construction of the french drain therefore the map does not depict the hydrologic regime before or after installation of the french drain. Water table maps representing pre-french drain conditions should be included in this report, particularly for high water table conditions (April through June)

6 The contention is made repeatedly throughout the document that the data show contamination has not migrated downgradient of IHSS 119 1 It is recognized in this report that the bedrock surface is incised with paleochannels where ground water flow should be concentrated However there are no downgradient monitoring wells located below well 0487 (which is contaminated) that are positioned in the paleochannel Well 4787 which is the only monitoring well on the hillside below well 0487 appears to be located on a bedrock high according to Figure 3 24 (bedrock topography) Therefore this well is probably not positioned to intercept the preferential flow path In order to characterize the extent of contamination downgradient from IHSS 119 1 a well might need to be installed in the paleochannel above the french drain

Section 5 0, Contaminant Fate and Transport

1 The contaminant fate and transport section (Section 5 0) of the RFI/RI report contains all the information suggested by EPA guidance (EPA 1988) This information includes a thorough discussion of factors that control the fate and transport of contaminants at OU 1 PRC s major comment on the fate and transport section of the RFI/RI pertains to its failure to include modeling of contaminant transport, particularly for volatile organic compounds (VOCs) in ground water The decision not to include ground water contaminant transport modeling is based on tenuous geologic interpretations a limited analytical data set, and some assumptions that need to be substantiated (for example that all southward migrating ground water in the upper HSU is captured by the french drain) Because contaminants in ground water could move faster and farther than expected, their movement should be modeled in this section of the RFI/RI report and compared to ground water data which still has not been presented for the areas down gradient of the proposed sources

Section 6 0, Baseline Risk Assessment

1 The introductory remarks to the risk assessment state that the loss of wildlife species is a yardstick of overall environmental quality The EE does not compare species found in OU 1 habitats with those found in Rock Creek habitats which was a common endpoint identified throughout the field sampling plan In fact it appears the use of Rock Creek for comparison may not be appropriate If this comparison can be made for those analyses it must be based on species numbers such as richness to be valid The source for the hazard index evaluation should also be provided The discussion as it stands seems arbitrary and should be supported by data

Appendix C Analytical Data

1 It is not possible with the existing semivolatile organic compounds (SVOC) data to assess the extent or level of polynuclear aromatic hydrocarbons (PAHs) contamination in OU 1 soils The utility of the SVOC data is limited for the following reasons

- *Most of the SVOC soil analyses were affected by aldol condensation products The high levels of these products in the SVOC analyses resulted in high detection limits* for the PAHs In many cases PAH detection limits were raised by one or two orders of magnitude These elevated detection limits would not allow the quantitation of PAHs present in low to moderately contaminated soils

- The compositing of soil samples from 6-foot subsurface soil intervals does not allow determination of environmental contamination particularly for chemicals with low aqueous solubilities such as PAHs Chemicals with low aqueous solubilities do not contaminate soil media evenly Rather they are transported in soils by preferential pathways and by physical or mechanical means resulting in a heterogenous distribution of the contaminants in the subsurface environment. The analysis of composited soil samples dilutes the concentration of the contamination and does not allow the risk associated with the contamination to be adequately assessed

2 In general the subsurface soil sample analytical result tables presented in Appendix C are in good order however the following errors or omissions were noted.

- Sample type abbreviations are lacking in many cases and when coupled with sample depths of 0 00 the results reported are meaningless

- Tentatively identified compounds (TICs) did not always supply the name of the chemical All TICs should be properly identified when possible

- Some matrix spike/matrix spike duplicate (MS/MSD) results were not properly reported, for example the SVOC analysis of sample 34291

3 Several soil VOC in bedrock, VOC in alluvial ground water and SVOC in alluvial groundwater entries in Appendix C do not list detection limits or list incorrect detection limits as 0 or 1 All data detection limits should be corrected in the final document.

<u>Appendix E Environmental Evaluation Review</u>

See EPA comments

<u>Appendix F Public Health Evaluation</u>

1 Chapter 2 of Appendix F should be completely reorganized It does not present the basic information necessary to determine whether the correct COCs were selected Although the essential information may be present elsewhere in the PHE it is difficult to locate and much of it appears to be missing It is not apparent why the pertinent information is scattered

throughout various appendices and attachments in the back of the PHE this information should be consolidated and presented in Chapter 2

2 Although the maximum and minimum concentrations and frequency of detection are presented for OU 1 contaminants in Tables 2 1 through 2 2d in Attachment F1 the sample quantitation limits the standard deviation and the upper 95 percent confidence limit are not provided but may be presented elsewhere in the report. This information should be summarized in Chapter 2

3 Site-specific background concentrations for each contaminant including the appropriate summary statistics are fundamental to the risk assessment. This information is only qualitatively presented in Attachment F1 and does not permit a detailed analysis or allow statistical comparison. For example when background contaminant levels are compared to site related contaminants the result of the statistical test is presented as either yes or no Additional information including a statistical summary and sample location should be provided that is consistent with background results developed in the Background Report and Workplan.

4 0 SPECIFIC COMMENTS

The following comments describe specific technical inadequacies and inconsistencies noted in specific portions of the RFI/RI report The comments reference a particular page and section number or table figure or appendix where appropriate For ease in reading these comments have been subdivided by section and appendix of the RFI/RI report Comments on tables and figures have also been subdivided Again comments on the EE and PHE reference the chapter or attachment number where appropriate

Section 1 0, Introduction

1 Page 1 2, Second Paragraph Two references are incorrectly cited in this paragraph Rockwell 1988c and DOE 1990b These should be corrected to Rockwell 1988a and DOE 1990c

Section 2.0. OU 1 Field Investigation

1 Page 2-6. First Paragraph. and Page 4-34. Third Paragraph The text in Section 2 2 states that RFP s sitewide air monitoring program referred to as the Radiological Ambient Air Monitoring Program (RAAMP) includes 53 air samplers However Section 4 4 describes 51 samplers Section 2 3 9 of the work plan states that the RAAMP includes 54 samplers The correct number of air samplers composing the network must be correctly stated

Section 3 0. Physical Characteristics of 4 OU 1

1 Page 3 16. Third Paragraph This paragraph identifies borings where siltstones and fine-grained sandstones subcrop below the alluvium and introduces Figure 3-23 which depicts the areal distribution of subcropping sandstones and siltstones based on drill-core descriptions The text and figure do not agree For example the text indicates that borings B32491 31291 and 4787 revealed subcropping sandstones and siltstones The figure does not. Two of the borings listed in the text (B302909 and B399790) do not appear on the well and borehole location map (Figure 3 27) These borings may also be located outside of areas identified on Figure 3 23 as having subcropping sandstones Discrepancies between Figure 3 23 and the text on page 3 16 must be resolved and the boreholes listed on page 3 16 must be correctly identified on the figure

It is also recommended that Figure 3 23 incorporate the results of the french drain excavation study (Appendix A-4) As pointed out in specific comment number 2 on page 19 this information should be of higher quality than information from drill-core descriptions The vertical cross section from station 11 + 00 to 11 + 50 presented in Appendix A-4 clearly shows sandstone and siltstone subcropping directly below the bedrock/colluvium contact however Figure 3 23 does not show subcropping sandstone and siltstone in this area

2 Page 3 16. Fourth Paragraph The text states the bedrock topography map (Figure 3 24) was drawn using bedrock depths reported in the geologic borehole logs and the french drain excavation investigation The french drain excavation provided a 2 000-foot long two dimensional cross section which was mapped in detail These data should be superior to the borehole data and should be given precedence when contouring the bedrock surface It does

not appear however that the french drain data presented in Appendix A-4 were used to refine the bedrock surface map Discrepancies of 10 to 15 feet are common between the top of bedrock as determined in the french drain geotechnical boreholes and the bedrock surface elevation mapped in the french drain excavation The bedrock contours on Figure 3 24 match the geotechnical borehole data but not the french drain excavation cross-sections presented in Appendix A-4 The bedrock surface map should be recontoured to incorporate the cross section data in Appendix A-4

3 <u>Page 3 20, Second Paragraph</u> The descriptions of the upper and lower HSUs given on this page are not consistent with the definition of the upper HSU listed on the previous page The text on the page states the upper HSU comprises Quaternary and Recent unconsolidated surficial material and a few discontinuous subcropping sandstones However page 3 19 states the uppermost aquifer at RFP is unconfined and is comprised of Rocky Flats Alluvium valley fill alluvium colluvium bedrock sandstones and weathered claystones of the Arapahoe and Laramie Formations The description on page 3 20 should be modified to include the materials included on page 3 19

4 <u>Page 3 22, Second Paragraph</u> The text describes seasonal water level fluctuations at wells 6487 and 6987 among others However wells 6487 and 6987 are not located at OU 1 but at OU 7 The text is probably referring to wells 6486 and 6986 which are located at OU 1 This error should be corrected

5 <u>Page 3 23, Fourth Paragraph</u> The text states the saturated thickness of the upper HSU ranges from 0 to 10 feet in the western portion of OU 1 The January 1992 saturated thickness map clearly shows that the saturated thickness of the upper HSU ranges from 0 to above 15 feet in the western portion of OU 1 This statement must be corrected

6 <u>Page 3 23, Fourth Paragraph</u> The text states the occurrence of ground water in this area (eastern OU 1) is limited to areas close to isolated recharge sources such as the north rim of the valley where seepage from the Rocky Flats Alluvium recharges colluvial materials Data available for much of the eastern portion of OU 1 are too sparse to support this statement particularly at the Rocky Flats Alluvium/colluvium contact (see specific comment

number 4 on page 52) This statement must be withdrawn or specify that it is limited to those areas where sufficient data are available

7 Page 3 24, First Paragraph The text states these figures (upper HSU cross sections) illustrate that ground water will be intercepted by the french drain under current conditions and that ground water in the upper HSU may be discharged to the South Interceptor Ditch below the french drain if water levels rise above the levels presented for first quarter 1992 This statement contradicts information elsewhere in this document that the french drain will serve as an effective discharge boundary and capture all contaminated water in the upper HSU of OU 1 This statement must be clarified and the contradiction resolved

8 Page 3 34, Second Paragraph This paragraph presents calculations intended to show that there is no exploitable volume of ground water in the upper HSU of OU 1 The paragraph however contains erroneous and misleading statements The text states Driscoll (1986) identifies low yield aquifers appropriate for domestic and other uses as having aquifer transmissivities of up to 0 015 square meters per second (m^2/sec) This *upper limit* was actually cited by Driscoll as 1 000 gallons per day per foot (gpd/ft) The value of 0 015 m^2/sec that the text attributes to Driscoll converts to 100 000 gpd/ft. Later in the paragraph the value that was computed from field data is presented as follows The resulting value of aquifer transmissivity for the upper HSU is 0 015 cm^2/sec This value is approximately 10 000 times less than that identified as appropriate by Driscoll and indicates that the upper HSU at the 881 Hillside area should not be considered as an aquifer capable of being exploited for any reasonable use The calculated value of 0 015 cm^2/sec converts to 10 4 gpd/ft which is *100 times* less than the upper limit for low yield aquifers identified by Driscoll and not 10 000 times less as stated in the text. Driscoll does not identify a lower limit for low-yield aquifers Misleading statements must be removed from the text Referenced limits must be clearly identified and reported in units consistent with the reference

9 Page 3 37, Third Paragraph The text states the french drain appears to effectively intercept all upper HSU ground water that could potentially flow southward from other OU 1 IHSSs The only data presented to substantiate this claim are contained in the upper HSU water table elevation map for April 1992 (Figure 3-44) This map shows dry conditions immediately

RE:012-C08054\rkyflats\oulrrev jas\1 28-93 downslope of the entire length of the french drain. The only data presented on this map are three wells located within 50 feet downslope of the french drain (31491 4787 and 38891) one of which (31491) has a water level 2 9 feet above the base of the well Well 4787 which is dry in April has a water level 5 5 feet above the base of the well in May 1992 Meanwhile the water level in well 31491 has declined almost two feet by May 1992 Conclusions about the effectiveness of the french drain must not be drawn until ground water data from the wells proposed in the FDPMP have been collected and analyzed

Section 4.0. Nature and Extent of Contamination

1 Page 4-3. First Paragraph The text states the purpose of the soil contaminant distribution maps was to include results for detections and nondetections and locations not sampled at the time of this report. However the analytical results reported in the soil contaminant distribution maps do not include all nondetection for all depth intervals It is difficult to determine the spatial extent of contamination and the total number of samples taken at a location without all contaminant detects and nondetects in the soil contaminant distribution maps This information must be added to the maps

2 Page 4-4. First Paragraph According to the text, Aluminum, calcium iron, magnesium manganese potassium and sodium were not to be included in the soil contaminant distribution maps In some instances these elements are included and should be removed

3 Page 4-6. Second Paragraph This paragraph discusses the isotopes of uranium It states that uranium 233 (U 233) is a natural isotope of uranium and occurs at an abundance of 0 7 percent However U 233 is not a naturally occurring isotope of uranium It is created by irradiation of thorium 232 in nuclear reactors (Weast, 1979) Therefore there is no background U 233 U 233 is fissionable and was a component of weapons production in Building 881 (CDH 1992) It must be clarified in this paragraph that U 233 may contribute to uranium contamination at RFP In addition Table 18 of the general radiochemistry and routine analytical services protocol (GRRASP) (EG&G 1990) states that uranium will be reported as U 233 234 U 235 and U 238 not as U 233 238 239 This must be stated in this paragraph

4 Page 4-10, First and Second Paragraphs These paragraphs discuss the location of IHSS 102 but do not indicate that new information places the oil sludge pit much nearer to Building 881 than had previously been assumed as shown on Figure 1 2 This information should be added in these paragraphs

5 Page 4-12, Third Paragraph This paragraph states that no metals samples were collected above 24 feet in depth at two borehole locations within IHSS 102 (BH 31291 and 31691). Because every 6-foot composite sample was to be analyzed for metals this deviation should be explained

6 Page 4-13, Second Paragraph. The last sentence of this paragraph states that radionuclide results for IHSS 103 subsurface soils are not available However the next page provides the subsurface radionuclide results The statement on page 4-13 should be deleted

7 Page 4-14, Fourth Paragraph This paragraph states that there may be a bias in the sampling set of radionuclides because samples were not collected below 12 feet in two boreholes The reason samples were not collected below 12 feet in these two boreholes must be provided

8 Page 4-21, First partial paragraph and Figure 4-36 This paragraph references an isolated detection of fluoranthene in BH 33591 However Figure 4-36 illustrates an isolated detection of di n butylphthalate rather than fluoranthene in this borehole The figure or text must be corrected to accurately reflect the data

9 Page 4-23, Second Paragraph The last sentence of this paragraph states that the distribution of drilling locations in the vicinity of IHSS 130 supports the determination of the areal extent of SVOC contamination. This statement is not supported by the data. SVOCs were detected in two of the three locations sampled The remaining five sample locations were not analyzed for SVOCs Therefore determining the areal extent of SVOC contamination is limited by sampling locations rather than of distribution of drilling locations This last sentence must be reworded accordingly

10 Page 4-34, Third Paragraph through Page 4-35, First Paragraph The text states The Radiological Ambient Air Monitoring Program is the existing area wide monitoring program

consisting of 51 on site locations at RFP along the RFP perimeter fences and within the Denver metropolitan area. Seven ambient air samplers are routinely monitored within OU 1 (Figure 2 2) An additional sampler (S 32) upwind of OU 1 provides data for background characteristics To provide more OU 1-specific air data, four high volume air samplers (S 81A S 81B S 81C and S-81D) were established in January 1990 (Figure 2 3) Tables 4-18 through 4-21 present data collected as part of the routine monitoring of air for OU 1 Unfortunately the RFI/RI report assumes that only samplers physically within OU 1 are appropriate for monitoring air for OU 1 It neglects the additional data obtained from the remaining air quality samplers in the Radiological Ambient Air Monitoring Program This view assumes that airborne transport of contaminants is a short range phenomenon. In other words Section 4 4 does not consider that airborne contamination originating from OU 1 may travel beyond the physical boundary of OU 1 However throughout the remainder of the RFI/RI report, a contradictory view of airborne contamination is presented For example in Section 5 3 2 4 (page 5-64) atmospheric transport is viewed as a long range scenario in which airborne contamination could travel beyond the physical boundaries of the RFP To provide a comprehensive review of the air quality impact from OU 1 the RFI/RI should review air quality data from all the air quality samplers of the RAAMP

11 <u>Page 4-34, Third paragraph through Page 4-35, First Paragraph</u> The text refers to the ambient air quality data collected at RFP However there is no reference to quality assurance and quality control (QA/QC) data throughout the RFI/RI. QA/QC data should be presented to assist in validating and qualifying the data obtained from the samplers

12 <u>Page 4-35, Third Paragraph</u> This paragraph states that the locations of surface water and sediment sampling stations are consistent with the locations presented in the work plan. Only the sediment sampling locations match those presented in the work plan. In addition surface water sampling stations are inconsistently referenced throughout this RFI/RI report For example the work plan listed 17 surface water sampling stations Figure 4-87 of this RFI/RI illustrates 14 sampling locations including location SW030 which was not listed in the work plan Table 4-22 lists 18 sampling locations of which three SW030 SW126 and SW125 were not listed in the work plan Two of the originally proposed sampling locations SW056 and SW020 are never listed in the RFI/RI report and were apparently never sampled Finally the data presented in Appendix C confirms that nine locations were sampled in the

fourth quarter of 1991 It is obvious that not all the originally proposed locations were sampled Therefore the text must be revised and the inconsistencies among the text, tables and figures must be corrected

13 Page 4-40, Third Paragraph This paragraph discusses radionuclide results in surface waters and states that they do not indicate contamination in surface water Though U 238 was detected at a level only slightly above background in sample SW046 U 233 234 were detected at concentrations nearly four times the background level The isotopic composition of this sample indicates that the sample may contain a component of synthetic U 233 or enriched uranium. Therefore the statement that surface water is not contaminated may not be accurate The uranium isotopic composition for sample SW046 requires further explanation in this paragraph

14 Page 4-43, Third Paragraph This paragraph discusses ground water analytical data and references Tables 4-25 and 4-26 This reference should be to Tables 4-26 and 4-27

15 Page 4-45, First Paragraph The text states that toluene was detected in three wells but lists only two Well 0974 should be added to the list of wells where toluene was detected

16 Page 4-46, Second Paragraph This paragraph discusses radionuclides in ground water within OU 1 and states that detected concentrations of americium cesium plutonium strontium tritium and uranium exceeded background levels but do not represent contamination. These data are not shown in Table 4-26 but should be included in both the table and text for completeness

17 Page 4-46, Third Paragraph This paragraph on metals contamination in ground water during the fourth quarter of 1991 is inconsistent with Figure 4-95 (which depicts metals detected above background levels in ground water during the fourth quarter if 1991) and omits important information The text states that barium was detected in well 35691 at a level of 0 245 milligrams per liter (mg/L) but figure 4-95 does not show any barium in ground water from well 35691 In addition the text states lead was detected in wells 5187 and 35691 at dissolved concentrations of 0 062 and 0 0118 mg/l Figure 4-95 shows these concentrations as total not dissolved lead

The text fails to list all of the analytes that were detected above the background level according to Figure 4-95 and the text on page 4-63 Page 4-63 states that dissolved nickel and zinc concentrations exceeded background levels by factors greater than 20 during the fourth quarter of 1991 However these analytes are not discussed at all on page 4-46 Also the metal concentrations that are reported are not consistently identified as dissolved or total metals In summary the test, figures and tables must be correct and consistent. The report should identify all metals detected above background levels and should consistently list and identify both dissolved and total metal concentrations

18 Page 4-48. Third Paragraph The contention that metal concentrations decreased from fourth quarter 1991 to first quarter 1992 cannot be supported by data presented in Sections 4 6 2 and 4 6 3 and Figures 4-95 and 4-97 A review of these data reveals that metals concentrations decreased to below background levels at well 35691 from fourth quarter 1991 to first quarter 1992 but that concentrations of several metals (chromium, copper strontium lead and zinc) in ground water increased from below the background level to above background levels at wells 5287 and 36191 over the same period Wells 5187 and 5487 which exhibited groundwater metal concentrations above the background level during fourth quarter 1991 (well 5487 had the highest levels of nickel zinc copper and antimony at OU 1) were not sampled during first quarter 1992 therefore no trend can be inferred from these wells Groundwater from well 0187 also had metal concentrations above the background level during fourth quarter 1991 but Figure 4-97 does not indicate whether this well was sampled during first quarter 1992 or if any metals were detected The contention that metals concentrations in ground water decreased from fourth quarter 1991 to first quarter 1992 must be withdrawn in this section and in Section 4 8 1 3

19 Page 4-52. First Paragraph The text discusses tissue analysis results that raised concerns However cadmium detections are not included The cadmium detected in two fish samples would seem significant because cadmium was not detected in any Rock Creek fish samples and because cadmium has persistent effects on fish reproduction. A rationale supporting the elimination of cadmium uptake as a concern must be provided

20 Page 4-52. Second Paragraph The text states that radionuclides were detected 19 times in OU 1 tissue samples The data tables provided in Appendix E Attachment E B however seem

to indicate that numerous radionuclide analyses remain outstanding The discussion must acknowledge the absence of these data and describe the significance of that absence

21 Page 4-53, Third full paragraph This paragraph states that surface water sediment, air and biota are considered secondary media. The RFI/RI report defines media as secondary when only sporadic occurrences of contaminants were found Because this report does not combine the data from all three phases of the investigation it is impossible to substantiate this conclusion. For example organics were detected in samples from only two of the surface water stations sampled during the Phase III investigation. However the three surface water sampling stations where organics previously had been detected (locations SW044 045 and 046) were not sampled during the Phase III investigation. Because only some of the surface water sampling stations were resampled during this investigation the conclusion that contaminants in surface water occur only sporadically does not appear valid Before concluding that these four media are all secondary the data sets from all three phases must be combined and analyzed

22 Page 4-56, First Paragraph This paragraph discusses radionuclide concentrations in surface soils and states that, with the exception of plutonium and americium they do not show any contamination trends It is true that ratios for uranium 234/238 are erratic but near a value of one in surface soils across the area of OU 1 Three samples next to Building 881 (RA036 RA037 and RA014) however show slightly elevated uranium 234/238 ratios possibly indicating enriched uranium contamination This is not surprising as building 881 was used to process enriched uranium in the past Therefore these elevated uranium 234/uranium 238 ratios require further explanation in this paragraph In addition the statement that all uranium is of natural origin disregards the surface soil radionuclide results presented in Technical Memorandum 5 (DOE 1992b) These results clearly show that depleted uranium has contaminated the soil at IHSS 119 1 Samples RA033 and RA032 also show slightly depleted uranium 234/238 ratios and must be discussed in light of the results from Technical Memorandums

23 Page 4-58, Second Paragraph This paragraph describes a detection of methylene chloride at borehole 37891 in IHSS 119 1 Figures 4-27 through 4-29 which illustrate the contamination at IHSS 119 1 do not indicate that methylene chloride was detected at this borehole but

rather at borehole 32591 The original data must be reviewed and the inconsistencies among the text, tables and figures corrected

24 Page 4-60, Second Paragraph The text states selenium is not detected in ground water thus its presence is not indicative of contamination in OU 1 soils However page 4-46 of the text states that selenium was detected in ground water at well 5187 at a dissolved concentration of 0 017 mg/L and a total concentration of 0 015 mg/L The statement that selenium was not detected in ground water must be withdrawn

25 Page 4-63, Second Paragraph The text states dissolved metals in ground water do not exceed background during first quarter 1992 This statement contradicts information on page 4-48 Page 4-48 states that dissolved strontium was detected above the background level (0 487 mg/L) in groundwater at well 36191 during the first quarter of 1992 Strontium also exceeded the background level in groundwater at well 5287 but the text does not specify whether this concentration was dissolved or total strontium and this concentration is not shown on Figure 4-97 The text must be modified accordingly

26 Page 4-63, Third Paragraph This paragraph discusses potential metals contamination in ground water and states that metals have been excluded from consideration as contaminants Exclusion of metals from consideration as contaminants should be delayed until further sampling demonstrates that metals concentrations in ground water have returned to background levels

27 Page 4-63, Third Paragraph The text states that aquifer trauma due to monitoring well installations is responsible for higher metals concentrations in wells sampled during the fourth quarter of 1992 This contention must be supported by data These data should include the location and installation dates of the newly installed wells and the locations and sampling dates of the monitoring wells where metals concentrations are said to have been affected

28 Page 4-64, First Paragraph The first sentence of this page states that the nature and extent of contamination in surface and subsurface soils and in ground water was determined by considering all VOC and SVOC detections and only those radionuclide and metal detections

that exceeded background This is not true Only those VOCs and SVOCs detected at levels exceeding detection limits by an order of magnitude or greater were considered contaminants This statement on page 4-64 should be corrected

29 Page 4-64. Third Paragraph This section discusses VOC contamination It states that all acetone 2 butonone and methylene chloride detected in subsurface soils and ground water were excluded as contaminants due to their low concentrations The only exception is methylene chloride detected at IHSS 119 1 However the data presented in Section 4 2 4 do not support this conclusion This section simply states that methylene chloride is a laboratory contaminant In addition a review of Tables 4-7 through 4-15 reveals that the IHSSs with the highest reported concentration of methylene chloride are IHSSs 102 and 130 and not IHSS 119 1 Because none of the IHSS discussions specify the detected concentrations of these analytes it is recommended that a discussion be added to the report to clarify the above referenced contradiction.

30 Page 4-69. Paragraph 2 This paragraph discusses radionuclide contamination in subsurface soils and states that the isotopic ratios of uranium indicate that subsurface uranium is attributable to natural processes and not to RFP processes This statement appears to be true with the possible exception of results from two samples from borehole 32091 on the south side of Building 881 Because the isotopic composition of uranium in these samples has been reported as U 233 238 239 and U 233 234 it cannot be clearly demonstrated that the uranium in these samples does not contain a component of enriched uranium or synthetic U 233 The analytical laboratory should be consulted to determine whether these results have been reported correctly

31 Page 4-71. First Paragraph The text states that a trend of decreasing concentrations with time in the new OU 1 wells reflects aquifer disruption from well installation. It should be noted that the wells have been sampled only twice Two samples are inadequate to establish a trend This statement and any others related to it should be deleted

Section 5 0, Fate and Transport of Contaminants

1 Page 5 31, Second Paragraph This paragraph begins a subsection on distribution coefficients and retardation factors This subsection appears to be misplaced This subsection may be better integrated into the discussion of contaminant physical and chemical properties in Section 5 2 1 2 retaining only the conclusions in Section 5 2 2 1 In addition some of the discussion on the distribution coefficients and retardation factors subsection repeats statements in previous sections This subsection should be evaluated for continuity with other sections

2 Page 5-40, Second Paragraph This paragraph concludes the discussion of the other semivolatile organic compounds without including a discussion of di n butylphthalate Di n butylphthalate was listed as a detected semivolatile compound in the first paragraph of this subsection and must be discussed

3 Page 5-45, First Paragraph This paragraph discusses the isotopic compositions of natural enriched, and depleted uranium. The discussion in the text uses the atomic percentages of the various isotopes of uranium. Table 5 16 however shows the weight ratios For technical accuracy and consistency the table must also contain the atomic percentages of the uranium isotopes

4 Page 5-46, Third Paragraph This paragraph begins a discussion of contaminant transport processes and behavior This section includes discussions of IHSS-specific and OU wide processes and is often repetitive For clarity this section should be organized by either process or IHSS and must include subheadings for these topics

6 Page 5 52, Fourth Paragraph This paragraph discusses VOC contamination in ground water south and southwest of Building 881 The paragraph discounts the importance of upgradient VOC soil contamination as the source of this ground water contamination. It does not, however offer any alternate sources for the ground water contamination in this area. Although the soil VOC contamination and ground water VOC contamination are dissimilar it is possible that contaminated soil or under building contamination (UBC) is the source of VOCs in ground water south of Building 881 Therefore potential sources should be discussed in this section

6 Page 5 55, First Paragraph The text states that the physical barrier that prevents ground water flow apparently is the bedrock lip or ridge depicted in alluvial cross-section F F' (Figure 3 16) However this is due to the distortion caused by a sharp bend in cross section F F rather than an actual bedrock high The bedrock surface below IHSS 119 1 should be better characterized to support or reject the existence of this anomalous bedrock high If shallow seismic data exist for this area, they should be analyzed

7 Page 5 55, Third Paragraph This paragraph discusses the variations in VOC concentrations in ground water at IHSS 119 1 and states that there is little or no net loss of VOCs from the area It does not, however discuss the possibility that moving ground water may be receiving a constant inflow of VOCs from soil sources resulting in relatively constant VOC concentrations in ground water This scenario remains should be discussed in this paragraph

8 Page 5 56, Fifth Paragraph This paragraph begins a discussion of ground water contamination in monitoring well 6286 Before concluding that VOC contamination in the ground water at this location represents contamination in the lower HSU derived from OU 2 additional sampling of alluvial ground water monitoring well 6386 should be completed In addition, more monitoring wells may need to be completed upgradient of monitoring well 6286 to determine the source of ground water contamination The present data are not adequate to assess the source of contamination in ground water at monitoring well 6286

9 Page 5-63, Second Paragraph This paragraph lists the COCs for modeling surface water or overland flow Pyrene is included as a COC in Table F2 2 of the appendix and should be added to the list on page 5-63

Section 6 0, Baseline Risk Assessment

1 Page 6-3, Third Paragraph The text states that the most important factor affecting species diversity in communities at RFP is the amount of moisture available to support plant growth and therefore provide food for animals Although this statement is similar to the conclusions in the EE it is not identical and leads the reader to conclude that the species lists for Rock Creek sites are markedly different from those for OU 1 sites The species lists for all habitats and a more detailed explanation of the effects of low precipitation should be provided

2 Page 6-4, Second Paragraph The text assesses toxicity and describes exposure of ecological receptors to contaminants Several organic soil contaminants were disregarded, such as PAHs PCBs and radionuclides These compounds should be considered in the EE because they are prevalent in surface soils In addition, the suspension of contaminated soil in air should be evaluated as a potential exposure pathway for terrestrial organisms The results of the bioaccumulation studies must be discussed

3 Page 6-8, First Paragraph The text states that impacts to intolerant species are reflected in species diversity This may be true but impacts to intolerant species will be noticed first with changes in community composition as the less tolerant species are replaced Species lists for the OU 1 and Rock Creek sites should be provided The lists should be compared by habitat type differences noted and a discussion provided of the reasons for observed differences

4 Page 6-9, Second and Third Paragraphs The discussions in these paragraphs seem to be force-fitting the Rock Creek areas as reference areas for OU 1 This seems to indicate that Rock Creek may not adequately resemble the OU 1 sites for use as a reference area. If the two areas are not similar enough for Rock Creek to function as a reference area, they should not be compared and the reference area method should be abandoned for OU 1 This possibility should be evaluated and discussed

5 Page 6-10, Third Paragraph The conclusions reached may require revision based on responses to comments on the remainder of the EE

Section 7 0, Summary and Conclusions

1 Page 7 5, First Paragraph This paragraph states that plutonium and americium contamination in soils are due to wind transport and deposition. The shape and orientation of the plutonium and americium contaminant plume is inconsistent with the proposition that it is related to wind dispersion The possibility that the contaminant plume is anthropogenic in origin should be discussed in this section. In addition several IHSSs contain significant levels of subsurface plutonium and americium in subsurface soils that should also be discussed in this paragraph

2 Page 7-6, First Paragraph This paragraph discusses the nature and extent of contamination at OU 1 but does not include subsurface soils Subsurface soils contain high levels of radionuclide and VOC contamination in certain IHSSs and should be discussed in this section

3 Page 7 9, Second Paragraph The paragraph discusses chemical and microbial degradation of VOC and SVOC contamination. No evidence for microbial degradation of these chemicals was presented in the fate and transport section of the RFI/RI report. Therefore this statement should be removed or further evidence to support the statement should be provided

4 Page 7 10, Fourth Paragraph This paragraph discusses ground water contamination in the area of well 6286 It states that this contamination should be evaluated under the OU 2 investigation. Because the source of this contamination is still unknown it should continue to be investigated during OU 1 activities until the data demonstrate that another source of contamination exists

5 Page 7 13, Second Paragraph Two types of data limitations are identified in the text. In addition it appears that some radiological bioaccumulation data are missing An explanation of the status of those data should be provided

6 Page 7 14, Second Paragraph, Bullet 6 The text suggests that surface soils in eastern OU 1 contaminated with radionuclides could be addressed in OU 2 studies Until that is accepted the areas in question are located within OU 1 and should be considered with OU 1 remedial activities

Tables (Volume I)

1 Table 2 1 This table compares proposed work and completed work Because so many inconsistencies were noted in this RFI/RI report description of proposed work, this table should be revised The table presented in Section 2 0 of this report should be used as a revision guide

2 Table 3 2 Surface water flow rates for 1990 are presented in this table however all of the ground water information presented in this report is from 1992 Because ground water and

surface water interaction is important at OU 1 surface water flow data from 1992 should be included in this table

3 Table 4-1 This table contains background contaminant concentrations for subsurface soils ground water surface water and sediments The text states that these data are from the Final Background Geochemical Characterization Report. As presently displayed the data in Table 4-1 cannot be cross referenced with the data in the Background Geochemical Characterization Report. References to the tables used in the Background Geochemical Characterization Report for these values should be included in Table 4-1

4 Table 4-2 This table contains background concentrations for surface soils used in the OU 1 report. The exact statistical procedure used to calculate these values should be presented with this table or in the appendix. Without discussing the method in more detail the validity of the data cannot be determined.

5 Tables 4-3 and 4-6 The quantitation limit for pentachlorophenol (PCP) in water is cited as 50 micrograms per liter (ug/L) in both Table 4-3 and Table 4-6 Both tables list a maximum contaminant level (MCL) for PCP as 1 ug/L which became effective January 1 1993 The laboratory method and the detection limit used for future work should reflect the change in the MCL

6 Table 4-25 Several ground water monitoring wells shown on this table were drilled before the Phase III RFI/RI began. This fact should be clarified in the table

7 Table 5 10 This table lists physical and chemical properties of semivolatile organic compounds including several PAH compounds A second list in the table lists other semivolatiles All of these other semivolatiles except PCB Aroclor 1248 and dibenzofuran are also PAHs The rationale for organizing the table in this manner is not provided The table may be better organized by separating the PAHs and other compounds The new table should also include 2 4-dimethylphenol 4-methylphenol pentachlorophenol benzoic acid Aroclor 1254 and di n butylphthalate which are discussed in Section 5 2 2 2

8 Table 5 14 This table displays the nuclear properties of the radionuclides detected at OU 1 Specific activity is given in picocuries per milligram (pCi/mg) in the table but as picocuries per gram (pCi/g) in the text. The table should be corrected to pCi/g In addition both radium 226 and radium 228 are naturally occurring isotopes of radium This should be clarified in the table

9 Table 5 16 Several of the values presented in this table do not correspond to the values plotted on Figure 4-83 The figure or the table should be corrected

Figures (Volume II)

1 Figure 3 21 Bedrock cross section I-I shows that piezometer 39291 is screened across two siltstone units The upper siltstone is contaminated with low levels of organics and appears to discharge into the french drain The lower siltstone is not monitored and may provide a pathway for upper HSU ground water to bypass the french drain. Moreover potentiometric water levels at this piezometer will be the average of the potentiometric water levels in the two individual siltstone units and therefore indicative of neither Piezometer 39291 should be abandoned as it provides a upper HSU ground water pathway to bypass the french drain and because potentiometric data from this piezometer may not be valid

2 Figure 3 28 The upper HSU water table map for January 1992 depicts large unsaturated areas Data are lacking for most of the unsaturated area to indicate that the upper HSU is dry A large data gap exists for the area north of IHSSs 119 1 and 119 2 this large area is indicated to be dry even though there are no data to suggest that a flow path is not continuous from well 37591 located near the 891 treatment plant, to IHSS 119 1 Also data coverage is too poor to support the contention that ground water at IHSSs 119 1 and 119 2 is restricted to isolated pockets Although a significant recharge boundary crosses this area (the Rocky Flats Alluvium/colluvium contact) no data have been collected that would adequately characterize this boundary Additional wells or piezometers would be required to fill in this large area of the map particularly well or piezometer pairs that straddle the contact.

In addition the depiction of the area south and west of Building 881 as dry appears to be inaccurate Two wells (39691 and 5187) are indicated to be dry even thougn Table 3 7 shows that the water level was measured above the bottom of the well screen. The rationale that the upper HSU is dry at these locations because the water level is below the bedrock contact is not valid because subcropping bedrock is included in the upper HSU if the ground water is confined (see specific comment number 3 on page 19)

A reverse hydraulic gradient or hydraulic barrier appears to exist between wells 35391 and 5387 Well 5387 contains approximately 6 feet of water while the water level at well 35391 which appears to be located about 25 feet upslope is below the bottom of the screen. An explanation for this unusual situation should be provided in the text.

3 <u>Figures 3 31 through 3 37 and Figures 3-41 through 3-43</u> The alluvial/bedrock contact is depicted as the dividing line between the upper and lower HSUs This allows the incorrect impression that all bedrock is included in the lower HSU and may lead to erroneous conclusions about the hydrogeologic system (for an example see specific comment number 4 on page 52) These figures must be revised to indicate the correct division between the upper and lower HSUs (see specific comment number 3 on page 19)

4 <u>Figure 3 39</u> The lower HSU potentiometric surface data should be interpreted with caution. The lower HSU consists of isolated sandstone and siltstone units that may or may not be in hydraulic communication. Contours should be drawn only between wells that are in hydraulic communication Figure 3 21 (bedrock cross-section I I') shows that wells 37891 and 39191 are in the same siltstone unit but piezometer 36991 is screened in a lower siltstone and piezometer 39291 is screened across two separate siltstone units If contours are drawn between wells that are clearly in the same unit, the resulting flow path may have a stronger eastward component, reflecting the regional dip A statement describing potential sources of error should accompany this contour map

5 <u>Figure 3-44</u> The upper HSU water table map for April 1992 depicts large unsaturated areas However data are lacking for most of the unsaturated area that would indicate that the upper HSU is dry All of the data gaps cited in the first paragraph of specific comment number 4 on page 52 also apply to this map Additionally a saturated area is shown extending from the northeast corner of the map to well 6386 which has a water level of 2 15 feet above the

base of the well The saturated area does not extend past this well and there are no data for the area downslope of well 6386 to support an unsaturated condition.

In summary the April 1992 water table map interprets conditions over large areas for which there are no data. The map should either be withdrawn or the areas for which there are no data coverage should be blank. Conclusions based on the portions of the map that are not supported with data should be withdrawn from the text.

6 Figure 4-11 This figure shows a result for U 239 and U 240 for borehole 30291 This is not the correct result for this borehole In addition, the result for borehole 30291 is incorrectly plotted for borehole 30191 in Figure 4-75 These errors should be corrected

7 Figure 4-97 Several metals concentrations that exceed background levels according to the text on page 4-48 are not shown on Figure 4-97 The text states that concentrations of strontium, lead and zinc exceeded background levels in ground water at wells 5287 and 35191 These concentrations should be added to Figure 4-97 and these results should be acknowledged in Sections 4 8 1 2 and 4 8 2 4

8 Figure 5 14 and 5 15 The figures depicting the conceptual model of present day ground water pathways at low and high water conditions do not show ground water infiltration to and movement in subcropping sandstones and siltstones which are included in the upper HSU The figures should be revised to show this pathway

9 Figure A4-2 In this figure the membranes used to line the french drain do not extend into its keyway as was intended in the approved construction specifications The actual placement of the membranes should be verified and shown correctly in this figure

Appendices

Appendix A. Geologic Data

1 Pages A1 3 through A1 5, and Table A1 2 The text and the table compare proposed field activities to actual field work. Both these sections of Appendix A state that only 45 boreholes

and 28 monitoring wells were originally proposed However the final work plan lists 54 boreholes and 37 monitoring wells The table and text must be revised to accurately reflect and justify deviations from the work plan. The table presented in Section 2 0 of this review compares proposed versus actual field activities and can be used as a guide for DOE s revisions

2 Table A1-4 This table lists locations not completed as monitoring wells and the relevant offset locations Two of the offset locations 38491 and 38791 were also abandoned In addition location 31791 is the offset location for MW36 and not MW33 as illustrated This table should be corrected accordingly

3 Page A4-3, First Paragraph The text explains that the french drain was not continued west of station 5 + 00 because ground water modeling showed that ground water in contact with any possible contaminant source would effectively be captured by the drain at its present western terminus The results of this ground water model and flow nets of the french drain area were presented by EG&G at a meeting with EPA and CDH in March 1992 to support EG&G s contention that construction of the french drain to its full projected length was unnecessary However EPA and CDH did not accept the flow net or ground-water model because of a lack of data for the west end of the french drain The FDPMP was developed and implemented to provide the data that EG&G s effort at ground water modeling was unable to produce The decision to extend the french drain beyond station 5 + 00 has been deferred until wet season (April through June) water levels have been collected at the new wells installed for the FDPMP and the data have been analyzed The results of ground water modeling must not be cited as conclusive evidence that the french drain will capture all contaminated OU 1 ground water without being extended west of station 5 + 00

Appendix C, Analytical Data

1 Appendix C, Table C 1 The qualifiers S1 and S2 have not been defined in this table but are used to qualify several metals analyses These qualifiers should be added to Table C 1

2 Appendix C, Table C 1 The detection limit for strontium is listed as 400 milligrams per kilogram (mg/kg) Table 16 of the GRRASP (EG&G 1990) lists the detection limit for strontium at 40 mg/kg This error should be corrected in all relevant data tables

Appendix E, Environmental Evaluation

See separate attachment

Appendix F, Public Health Evaluation

1 Page F2 1, Second paragraph This paragraph outlines the database used to select COCs and introduces the methodology which was employed to eliminate chemicals from the risk assessment However insufficient information is presented to assess the validity of COCs selected The process of selecting COCs involves the sequential application of elimination criteria, which are used to narrow the focus of the risk assessment to OU 1 contaminants presenting a significant risk. This process should begin by presenting an inventory of compounds detected at least once in each OU 1 medium. Along with the chemical inventory this chapter also should present the range of sample detection limits detection frequency and summary statistics which include the concentration maximum, minimum mean and upper 95 percent confidence limits This information must be presented in a single table to facilitate comparison (A sample table has been included in this review)

2 Page F2 3, Figure F2 1 This figure presents the protocol for identification of COCs It is well designed and contains all the pertinent criteria needed to select COCs and has the decision points in the proper sequence However it cannot be ascertained whether this paradigm was applied in the selection process due to a lack of basic information discussed in specific comment 1 above

3 Page F2-4, Second Paragraph This paragraph describes how the data were processed for the risk assessment One critical aspect of a risk assessment is the method of compiling analytical data that are used to estimate exposures and subsequent risk It is unclear how these data were compiled out for each media in OU 1 It is also not readily apparent what soil profiles were combined for the analysis For example it would be inappropriate to group subsurface

and surficial soil data with regard to radionuclides since radionuclides are only present in the uppermost surficial soils Thus subsurface clean samples would effectively dilute the calculated concentration if they were combined with surficial samples It would also be incorrect to combine subsurface contaminants with surficial soil contaminants for residential exposures because residents would not be expected to come into contact with deeper contaminants In fact, it is sometimes necessary to select a different set of COCs for different exposure scenarios depending on where the contaminants are localized The location of soil contaminants in different soil profiles must be revised accordingly to support the rationale for selecting COCs for individual exposure pathways and scenarios

4 Attachment F1 2, Page 2 2, Fourth Paragraph This paragraph presents an unacceptable method to deal with elevated sample quantitation limits (SQLs) It is incorrect to eliminate samples with elevated detection limits before reviewing the analysis of each compound individually The Risk Assessment Guidance for Superfund (RAGS) (EPA 1989) indicates that samples with high SQLs can be eliminated from the quantitative risk assessment only if they cause the calculated exposure concentration to exceed the maximum detected concentration for a particular sample set. By eliminating samples prematurely the data set becomes biased All SQLs must be considered when statistical summaries are prepared for each chemical

5 Attachment F1 2, Page 2 14, Second and Third Paragraphs These paragraphs describe the statistical analysis employed in the baseline risk assessment to eliminate inorganic chemicals from the risk assessment. The description of the statistical test must be clarified When a statistical test is applied the null hypothesis states that the difference between the background and site means is zero Instead this paragraph indicates that when the population variances were equal the contaminant and background populations are equal This is not correct, since it possible that two population variances can be equal yet the means differ by several orders of magnitude In other words the null hypothesis is concerned only with the arithmetic or geometric means and not with the variance Sample population variances are only important insofar as ensuring the appropriate statistical test was selected This point is critical because so many chemicals were eliminated from the risk assessment using the background criteria The statistical methodology must be revised

6 Page F3-4, Last Paragraph This paragraph indicates that the water table fluctuates seasonally by several feet during the year As a result, the subsurface soil above IHSS 119 1 is likely to be highly contaminated The ground water which contains high concentrations of several organic compounds including carbon tetrachloride would be expected to leave a residue in subsurface soil as the ground water receded from its highest level during the year The impact of this phenomenon is not described in any other part of the PHE and should at least be addressed in the exposure section because in this assessment, the highest risk associated with OU 1 involves inhalation of these contaminants from ground water

7 Page F3 10 through F3 13 These pages describe the list of possible current and future OU 1 receptors They appear complete except that dermal exposure to soil contaminants has not been included as a potential exposure pathway for any of the receptors This oversight must be corrected

8 Page F3 22, Fifth Paragraph, and Page F3 24, First Paragraph The text states While lower wind speeds reduce the amount of dispersion (thus increasing the potential concentration of airborne contaminants) higher velocity winds result in significantly higher emission rates of contaminated soils than do lower velocity winds since the erosion rate is a cubic function of wind speed This statement is too general and sweeping The text must clearly define what is meant by significantly higher emission rates

9 Page F3 22, Fifth Paragraph through Page F3 25, First Paragraph These two sections describe the general nature of the dispersion model used to characterize risk exposure from airborne contaminants The PHE report does not, but should present examples of the computer runs of the dispersion model These examples will aid in the evaluation of the conclusions drawn from the dispersion model

10 Page F3 27, Fourth Paragraph through Page F3 38, Second Paragraph The text describes the equations used for soil gas modeling An acceptable technical or regulatory justification for choosing each equation has not been, but should be provided

11 Page F3 32, First Paragraph The MDL plotting method by Helsel and Cohn which was used for censored data is acceptable as long as important criteria are met Among these is the

percentage of samples in which contaminants were detected When the chemical is detected in 80 percent or more in all samples in each media, the MDL method can be used to estimate censored data In contrast, when a chemical is detected in less than 80 percent of the samples one half the detection limit must be used The opposite approach was presented in this section and must be corrected

12 -- Page F3 32, Third Paragraph This paragraph presents basis assumptions made in the Johnson and Ettinger model Although the purpose of the soil gas model is to estimate exposures to residents in residential housing units modeling assumptions that pertain to commercial structures are used There are no ventilation requirements for residential housing The assumption that residential buildings will undergo a complete air volume exchange every hour is not realistic This will seriously reduce the point estimate concentrations and will artificially attenuate potential exposures to residents Therefore this parameter must be revised to a more realistic and supportable value

13 Page F3 38, First Paragraph This paragraph describes the point estimate for gas concentrations were derived It is unclear why a Monte Carlo Simulation is necessary to derive a point estimate for gas concentrations with the Johnson model (and why only 100 simulations in Latin Hypercube were carried out) It is equally unclear how probability density functions are being constructed when nothing is known about the shape of the curve for each input parameter and a data base does not exist. It is would appear easier and more scientifically tenable to use the central indicator statistic for each parameter rather than to derive values that are suspect for such an important phase of the risk assessment. In addition the upper 95th confidence level for each parameter must be used in these calculations

14 Section F4 Section F4 presents the toxicity assessment Several toxicity values listed in the toxicity constant tables in this chapter are inconsistent with EPA verified values The toxicity values must be reviewed to ensure compliance with EPA guidance Not only the toxicity assessment but in the toxicity concentration screen (presented in Attachment 2) must be changed as well The following is a summary of the inconsistencies

- Page F4-6 The oral RfD for 1 1 1 trichloroethane is 9E 2 milligrams/kilograms-day (mg/kg-day) (Health Effects Assessment Summary Tables [HEAST] 1992) (EPA 1992b)

- Page F4-6 The uncertainty factor for oral and inhalation RfDs for 1 1 1 trichloroethane is 1 000 and the inhalation RfD for trichlorofluoromethane is 0 71 mg/kg-day (HEAST 1992)

- Page F4-14 The inhalation slope factor for carbon tetrachloride is 0 0525 mg/kg-day The legend on this table is incorrect.

- Page F4-16 The constants listed in table F4-4 for radionuclides are correct but are from HEAST 1992 not HEAST 1991 as listed

- Page F4-18 The Integrated Risk Information system (IRIS) provides an inhalation unit risk value for carbon tetrachloride of 1.5E 5 microgram/cubic meter (μg/cum) which corresponds to a slope factor of 0 0525 mg/kg-day (EPA, 1992a) The value listed is from HEAST 1991

- Page F4-21 The oral RfD listed for 1 2-dichloroethene is from IRIS and the inhalation value is from HEAST 1992

- Page F4-23 The RfD listed for methylene chloride was from HEAST 1991 and has been withdrawn from HEAST 1992

- Page F4-23 The inhalation slope factor for benzo(a)pyrene is from HEAST 1992

- Page F4-26 The toxicity values listed for radionuclides are from HEAST 1991 Values should be taken from HEAST 1992

- Page F4-30 An inhalation RfD is available from HEAST 1992 for 1 1 1 trichloroethane

- Attachment F 1 Page 2 The slope factor for indeno(1 2 3-c d)pyrene is 0 61 not 0 1 mg/kg-day

- Technical Memorandum 8 The correct RfD values for 1 1 2 trichloro-1 2 2 trifluoroethane is 0 3 mg/kg-day dichlorodifluoromethane is 0 2 mg/kg-day trichlorofluoromethane is 0 3 mg/kg-day

15 Page F4-10, Last Paragraph This paragraph presents unnecessary opinions about the risk assessment process It seems inappropriate to present opinions about the validity of EPA s risk assessment approach in the baseline risk assessment, which is being carried out according to Superfund guidance (EPA 1989) Moreover the particular recommendations made by a single group such as the Harvard School of Public Health are irrelevant. The approach taken by EPA in estimating risk was developed by the National Academy of Science and is endorsed by many other scientific groups and institutions Opinions about the risk assessment

process whether consenting or dissenting must be omitted from the main body of the risk assessment.

16 Page F4-11, Recommendation 2 This recommendation suggests replacing the current methodology If there was an inexhaustible source of completely tenable toxicological information on the carcinogenic potential of all chemicals this recommendation would be implemented. However scientists must make decisions based on incomplete data sets Rarely is there enough carcinogenic information to construct a complete probability density function for carcinogenic potency values as suggested Therefore this recommendation must be eliminated from the PHE

17 Page F4-16, Table F4-3 This table presents toxicity values The Carcinogenic Risk Assessment Verification Endeavor (CRAVE) Work Group has verified 5 8 mg/kg-day as the new oral carcinogenic slope factor (CSF) for benzo(a)pyrene It must be used instead of the CSF presented in the table All other carcinogenic PAHs must be based on this value using the toxicity equivalency methodology (TEF)

18 Page F4-16, Table F4-4 This table presents CSFs for radionuclides The toxicity constants for external exposure to radionuclides have not been included in the table This exposure pathway could be significant and must be included in the analysis for americium (Am) 241 and plutonium (Pu) 239 and 240 As noted on page F4-26 these radionuclides decay by emission of various X rays and gamma rays Am and Pu could contribute significantly to human exposure at the concentrations detected onsite As a result, the table must list toxicity constants for Am and Pu

19 Page F5 3, Second Paragraph This paragraph states the goal for using a Monte Carlo simulation Although this technique is an effective statistical method that can be used to refine an estimate of risk and assess uncertainty it should not be used as the single benchmark against which all other estimates of risk are measured This limitation applies principally because the Monte Carlo simulation itself contains a high degree of uncertainty Sufficient information is rarely available to construct detailed probability density functions (PDFs) for the exposure or toxicity input variables Instead PDFs are frequently based on tenuous assumptions which in many cases are just the best professional guess For

example it is often assumed that sample data are lognormally distributed without sufficient supporting information As a consequence of the uncertainty surrounding these assumptions the degree of uncertainty within the Monte Carlo simulation cannot be ascertained or quantified The uncertainty within the Monte Carlo simulations must be discussed

20 Page F5-6, Third Paragraph This paragraph discusses the uncertainty inherent in estimating chemical intake based on the mean concentration Since the extent to which PDFs can be defined is severely limited for many input variables incorrect assumptions about PDFs skew the results of Monte Carlo simulations as well Consequently the uncertainty surrounding the selection of the type of distribution curve for the Monte Carlo simulation must be discussed in detail and added to the uncertainty section

21 Page F6-3, Table F6-1 This table lists CSFs for COCs As previously noted CSFs for carcinogenic PAHs must be changed to reflect EPA s newly verified values

22 Page F6-4, Second Paragraph This paragraph describes the methodology which was used to estimate total risk from all COCs It is not clear why no attempt was made to add potential carcinogenic risk across the pertinent weight-of-evidence classes Although chemical and radiological carcinogenic risk must be added separately risk associated with compounds within these two classes should be combined to derive the cumulative risk

23 Page F6-6, Last Paragraph and Table F6 2 This paragraph and table present the estimated risk associated with OU 1 exposure There is an inconsistency between the text and Table F6-2 with regard to calculated risk. For example the text states that the risk associated with inhalation of plutonium 239 and 240 is 3 1E 9 while the table indicates the risk is 2 64E 9 Similar discrepancies were noted in this section and must be corrected

24 Page F6-7, Table F6-2 This table presents a summary of predominant risks As noted in section F6 11 of the PHE risk is the product of chronic daily intake (CDI) and the slope factor or the reciprocal of the reference dose This information which is necessary to verify calculated risks is completely lacking in this table This information must be included along with the upper 95th percentile concentration which was used to calculate the CDI

25 Pages F6-7 through F6-10 and Tables F6-2 through F6-3 These tables summarize site-related risks It is inappropriate to present only a summary of predominant risks A complete list of all risks associated with an individual chemical must be presented Furthermore a presentation of narrowly selected risks introduces bias because the selection process is subjective Carcinogenic risks must be organized according to exposure pathways and combined across all exposure pathways Noncarcinogenic risks must be presented as hazard indices and combined either across all exposure pathways or according to organ system

26 Page F6-11, Second Paragraph This chapter discusses worker exposure It is not clear what is meant by the statement that worker exposure is regulated by occupational standards There are no regulations to protect RFP workers from OU 1 contaminants Contaminants have yet to be characterized and regulations to protect workers such as those promulgated by the Occupational Safety and Health Administration (OSHA) pertain only to chemical exposures that occur during routine occupational operations In these cases the concentration of chemicals in the work place are well characterized and exposure duration strictly limited These regulations do not apply to exposure to hazardous waste contaminants at Superfund sites This section must be eliminated from the risk assessment

27 Page F6-12 This page shows permissible worker exposure levels It is not necessary to include a comparison of a hypothetical future on site worker to occupational guidelines for a Superfund risk assessment. Moreover the manner in which the comparison is made is misleading Threshold limit values (TLVs) do not indicate risk and must not be directly compared to onsite concentrations for several reasons First, TLVs are derived by the American Conference of Governmental Industrial Hygienists (ACGIH) which is an organization of professionals not a governmental agency The ACGIH recommendations are seriously considered but are not automatically adopted by official governmental agencies Second the estimated concentration of each contaminant in indoor air at OU 1 is based on a gas transport model which is associated with considerable uncertainty Ambient air concentrations in contrast, are directly and closely monitored in the work place which enables direct comparison with TLVs Finally TLVs must not be used as a benchmark or viewed as synonymous with risk since they provide no indication of risk. For example the calculated carcinogenic risk for 1 1-dichloroethene at the TLV of 20 0 milligram/cubic

meter (mg/m^3) using the modeled input parameters in the OU 1 risk assessment is 2 3E 1 for occupational exposure This risk level exceeds EPA s acceptable risk range of 1E-6 to 1E-4 Although the disparity between ACGIH s TLV and EPA s acceptable risk level distinguishes the differences between the two scientific approaches it does not invalidate EPA s methodology used to calculate risks at Superfund sites Consequently TLVs must not be used to represent or compare safe exposure levels in the risk assessment for OU 1 unless the purpose is to submit it to OSHA

28 Page F6-18, Section 6.5 This section summarizes the risk characterizations Because the entire risk characterization is a summary of the carcinogenic and noncarcinogenic risks a further summary of the summary is unnecessary

29 Page F6 18, First Paragraph This paragraph identifies the data which were used to calculate risk. It is not clear what OU 1 data in what media are being used to calculate risk. Although the text states that Phase III data analyses are reflected in the evaluations it is not apparent what specific data are being used One data set must be used throughout the entire risk assessment. It would be incorrect, for example to use one set of data for selecting COCs and another to calculate risk. This discrepancy must be clarified since it was noted in the COC selection section that pre-Phase III RFI/RI environmental data, data collected during the Phase III RFI/RI, and supplemental surface soil sampling program data were used to select OU 1 COCs

30 Page F6-18, Last Paragraph This paragraph compares risk associated with on site COCs to background chemicals Although it is sometimes helpful to place risks in perspective for the general public the perspective should not be distorted For example although exposure to naturally occurring substances poses risk, the background concentration cited for comparison must be site specific and not the national or worldwide average Furthermore since radionuclides and PAHs in OU 1 are considered anthropogenic the risks associated with these classes of chemicals must not be viewed as background risks

31 Page F6 21, Fourth Paragraph It may be true that occupational exposure to plutonium is more likely to produce detectable health effects than are environmental exposures but adverse health effects associated with environmental exposures are likely to go completely undetected

This is because workers in the nuclear weapons production industry are not only under close medical monitoring programs to detect early adverse effects but operate under strict regulations that limit exposures In contrast environmental exposures cannot be evaluated because Superfund sites are for the most part, uncharacterized Therefore exposure to the contaminants cannot be regulated Detection of adverse health effects from environmental exposures to plutonium is further complicated by the long latency between exposure and tumorigenesis This entire section is deceptive and must be eliminated from the risk assessment.

32 <u>Page F6-23, Second Paragraph</u> The statement that The linearized multistage model (LMM) is a health-conservative mathematical algorithm which has never been validated, but is selected by regulators more for its utility in making decisions than for its scientific voracity is misleading unjustified, and must be deleted from the risk assessment. While it is true that the multistage model has not been validated no low-dose extrapolation model has ever been validated Moreover it is a scientific impossibility that any extrapolation model will ever be unequivocally validated in the future It is also untrue that the LMM used more for decision making than for scientific purposes Many scientists not only endorse the LMM for determining low dose effects but believe it more accurately represents the initial biological changes that occur during carcinogenesis than do other available models It should be noted that unlike the single hit model the LMM is not the most conservative model that EPA could have chosen. In any event, EPA believes it is the best available low-dose extrapolation model

33 <u>Page F6-23, Third Paragraph</u> This paragraph attempts to diminish risks associated with exposure to OU 1 COCs It is misleading to focus solely on 1 1-dichloroethene throughout the discussion of predominant risks associated with OU 1 and then finally conclude that it is not significant because it is a Class C carcinogen This gives the reader the impression that only 1 1-dichloroethene is present at levels that may pose unacceptable risk but that it is not a concern because its carcinogenic potential in humans is questionable Carbon tetrachloride is also present at unacceptable risk levels at 4E-4 and it is a Class B2 carcinogen (probable human carcinogen) The risk from this human carcinogen must be included in the discussion when risks are put into perspective

34 Page F6-24. Table F6-6 This table presents OU 1 carcinogenic risk. Although the RME Hotspot, and Clean risk values are adequately presented, the percentiles of risk are confusing and not germane to this section. They appear to represent the results of a Monte Carlo simulation which should not be included in the risk characterization. If these percentile values are the output from a Monte Carlo analysis they must be presented in the uncertainty section. It is interesting to note however that there seems to be more uncertainty in the percentile values derived from the Monte Carlo analysis than there is in the RME This is surprising because the sole purpose of the Monte Carlo analysis is its use as a benchmark to measure uncertainty For instance the variability in upper 95 percent confidence limit values ranges widely from 5E 13 to 7E 5 which is approximately eight orders of magnitude In contrast, RME values vary by only two orders of magnitude An explanation of why the RME and upper 95 percent values vary so widely is also needed

35 Attachment F3 3. Page 30 First Paragraph The first paragraph in this section states that 31 plutonium values were used for geostatistical analysis However Figures 4-1 through 4-3 show only 26 sample locations The text must indicate exactly which data were used for geostatistical analysis either in a table or as a reference to a specific table in an appendix that contains the data.

36 Attachment F3 3. Pages 30-35. Figures 4-1 through 4-3 The results of the kriging and contouring of plutonium values are presented in Figures 4-1 through 4-3 These figures show several closed contours centered near the coordinates 2085920 east, 748300 north suggesting a source of plutonium contamination in this area. However Figure 4-85 in Section 4 0 of the RFI/RI report shows open contours to the northeast of the coordinates 2085920 east 748300 north suggesting a contamination source to the northeast of the figure area. Presumably both Figures 4-1 through 4-3 from the PHE and Figure 4-85 from the RFI/RI report were generated with the same plutonium data, yet the patterns are different. A comparison of the two patterns suggests that an isolated study area was considered for the PHE while a larger area of influence was considered for the RFI/RI If a more limited study area was used for the PHE the scientific rationale for disregarding other potentially influencing data must be provided If there is another reason for the different patterns an explanation must be supplied

37 Attachment F3 3, Page 34 This section states The inadequate number of sample data and their alignment in a north northeast direction suggests that a detailed geostatistical analysis of other analytes in surface soil samples may not be beneficial However the last sentence in this section states that kriging with SURFER software may provide insight to the distribution of contamination across OU 1 even though results of kriging using a directional semivariogram model in GeoEAS provided no significant differences from the results of kriging with a linear semivariogram model in SURFER software The text must clearly state whether

(1) The geostatistical analysis of plutonium data is considered technically sound using the number of data points available and using either of the semivariogram models (directional or linear) tested,

(2) Geostatistical analysis is recommended for interpretation of data for other analytes and

(3) Geostatistical analysis of other compounds is considered sound only if a particular semivariogram model is used

5 0 SUMMARY AND CONCLUSIONS

The preceding sections have discussed in detail the technical inadequacies and inconsistencies noted in the RFI/RI report PRC believes that this RFI/RI report should be substantially rewritten to address all the problems noted in this review The data generated from the investigation are generally presented in a poor manner Complete summaries of the raw data were never prepared and numerous inconsistencies and inadequacies were noted in brief data summaries provided in the text, tables and figures throughout the RFI/RI report. This poor data presentation made it impossible to verify and check most of the conclusions drawn in the RFI/RI report Some of the other major issues include failure to combine data from all three phases of the RFI/RI investigation calculation of upper HSU volume based on suspected estimates of total saturated area, numerous assumptions regarding the concentration level at which an analyte is considered to represent contamination questionable useability of the SVOC particularly the PAH data, and the inability to review the EE and PHE because of the data presentation and structure of these sections

To clearly illustrate the shortcomings of this draft version of the RFI/RI report, PRC has reviewed each of the 17 objectives of the Phase III RFI/RI investigation. Section 7 0 of the RFI/RI report presents each of the 17 objectives and uses information in the previous sections of the report to substantiate the claim that each of the objectives had been met. PRC s review of the objectives revealed that the majority of the objectives were not met The following text describes each objective and indicates whether the objective was met. The examples referenced in each discussion are summaries of the major deficiencies of the RFI/RI report as noted in the general and specific comments

Objecti e 1. Determining the extent of saturation and ground water flow directions both spatially and temporally for the unconfined flow system

This objective has not been met because an accurate determination of the extent of the saturated area is essential to the estimation of exploitable ground water in the upper HSU at OU 1 The estimates of saturated area presented in Table 3 16 are based on upper HSU water table elevation maps which extrapolate unsaturated conditions over large areas where water level data are lacking and are therefore unsatisfactory Many statements in the text are based on the water table elevation maps and must be withdrawn unless a better estimate of saturated area can be provided

Objective 2. Describing the interaction between surface water and ground water

This objective has not been met because there is no indication that data were collected specifically to describe surface water and ground water interaction Surface water data provided in Table 3 2 are from a different year than the ground water data used as the basis for the water table elevation maps No data have been collected to describe surface/ground water interaction where ground water seeps out at the edge of the Rocky Flats Alluvium Additionally there are no wells near either side of this recharge boundary resulting in the largest data gap on the water table elevation maps Finally the surface water flow monitoring stations proposed in the FDPMP have yet to be installed These stations were proposed for the culverts west of Building 881 which would fill an important data gap and help characterize the saturated area west of the french drain (the section of the proposed french drain that was not installed)

Objective 3 Quantifying aquifer properties for the upper and lower HSUs

This objective was not met because the volumetric calculations provided in Section 3 7 3 4 and Table 3 16 should be recalculated because the extent of the saturated area may have been underestimated The credibility of the section on upper HSU ground water volume may be suspect because an important reference (Driscoll 1986) appears to have been misquoted

Objective 4. Describing all soil and rock materials

This objective appears to have been adequately addressed although specific errors may remain See Section 4 0 of this review for the applicable specific comments

Objective 5. Refining the hydrogeologic site conceptual model for OU 1

This objective has not been met. The text on page 7 3 states that all historical and Phase III RFI/RI hydrogeological data, as well as subsequent water level data have been integrated into a refined hydrogeologic conceptual model that was verified against field observations and contaminant distributions However there are few indications that analytical results and water levels prior to fourth quarter 1991 have been incorporated into the Phase III RFI/RI report. Nor does it appear that data from the french drain investigation have been incorporated into the report. The hydrogeologic conceptual model for the vicinity of IHSS 119 1 is based on assumed physical features that may not exist. The model cannot be verified with contaminant distributions because satisfactory downgradient data have not been provided The text also states Much of the model is explained in discussion of the interaction of surface water and ground water in objective (2) However data on ground water/surface water interaction are virtually absent, in fact, surface water data are not even provided for the same year as ground water data Finally the text states this refined conceptual model confirms that the french drain and accompanying extraction well function as effective discharge boundaries and intercept all identified upper HSU ground water flow paths originating from or passing through OU 1 A conceptual model is a hypothesis to be tested only field data can confirm that the french drain intercepts all contaminated ground water in the upper HSU

Objective 6. Determine the nature and distribution of waste materials on site

This objective was not met. Although boreholes were drilled directly through some IHSSs IHSS 102 was not investigated because it was mislocated at the time of the Phase III RFI/RI investigation In addition, the inconsistencies noted in the subsurface soil data presentation and interpretation (inconsistencies among text, figures tables and appendices) make it difficult to substantiate the conclusions drawn regarding distribution of waste materials To determine whether the investigations have met this objective the data should be reevaluated and presented in a more logical and consistent format.

Objective 7. Characterize soils in the proximity to the removed wastes as potential contaminant sources

This objective has not been satisfied completely Although data were collected from both surface and subsurface soils the inconsistent data presentation makes it difficult to substantiate the conclusions drawn in the RFI/RI report. In addition, the failure to incorporate all three phases of data collection also makes the conclusions drawn from only the Phase III RFI/RI data suspect. Again this investigation s ability to meet this objective cannot be fully evaluated until the data are presented in an improved format.

Objective 8. Determining whether site or subareas of sites were potential sources of contaminants in ground water

This objective has only been partially met because the analytical ground water data presented in this report are too limited to determine whether sites in the western part of OU 1 and IHSS 119 2 contribute to ground water contamination For much of the western area, metals data were not available for first quarter 1991 The decreasing trend in metals contamination in ground water cited in the RFI/RI report is unsubstantiated because most of the wells in the contaminated area were not sampled during first quarter 1992 The low water levels at IHSS 119 2 similarly restrict the amount of data collected in this area. These problems may be alleviated by obtaining historical data from periods of high water table conditions

Objective 9 Determine the extent of radionuclides in surface soils

This objective was only partially met. Although the field investigation was conducted as proposed the data from the first two investigations were not included in this RFI/RI report. This is of particular concern because the Phase III investigation was planned to enhance the previous studies Therefore the extent of radionuclides contamination in surface soil at OU 1 cannot be determined until all three data sets are combined and interpreted -

Objective 10. Determining nature and extent of ground water contamination in surficial materials

This objective has not been met because the nature and extent of ground-water contamination in the downgradient areas is poorly defined The only data provided are from the fourth quarter of 1991 and first quarter of 1992 when low water table conditions limit the number of downgradient wells that can be sampled In addition downgradient wells may be poorly positioned with respect to the preferential flow paths (existing wells may be located on bedrock highs) These problems may be alleviated by historical data from periods of high water table conditions

Objective 11. Determining the location and extent of weathered and unweathered sandstone units and associated contamination

This objective has been satisfied only in the vicinity of IHSS 119 1 where three monitoring wells were installed in one sandstone unit. Subcropping sandstones are more common at the site than depicted in Figure 3 23 (distribution of subcropping sandstones) The french drain cross-sections in Appendix A-4 show that subcropping sandstones are common from station 10 + 00 to station 13 + 50 of the french drain excavation. The focus should be on the existence or extent of contamination in sandstones or siltstones that are deeper than the french drain excavation such as the lower siltstone in Figures 3 21 and 3-42 (bedrock cross section I I)

Objective 12. Characterize the quality of surface water

This objective has not been met because not all of the proposed surface water sampling stations were sampled and some previously sampled stations were not resampled Until all the data are available it is difficult to draw substantiated conclusions regarding the quality of surface water In addition the current format for presenting data in the RFI/RI report does not allow for an easy verification of sample results presented in the appendices

Objective 13. Characterize radionuclides in Woman Creek sediments

This objective was not met because none of the sediment radionuclide data were discussed in the section on nature and extent of contamination. In addition the current data presentation format does not allow for easy verification of sediment sample results

Objective 14. Data management procedures

This objective could not be interpreted based on the RFI/RI report as it involves internal DOE & EG&G policies

Objective 15. Data quality

This objective was not met because problems were noted in the quality of the data presentation. These include inconsistencies throughout the text, tables and figures

Objective 16 Determine contaminant fate and transport

This objective was only partially met. Although the fate and transport section contains a thorough discussion of factors that control the fate and transport of contaminants at OU 1 it does not include modeling of contaminant transport in ground water In addition the decision to exclude ground water contaminant transport is based on tenuous geologic interpretations a limited data set, and some assumptions that may not be valid specifically that the french drain captures all the southward migrating ground water in the upper HSU Until this information is included in the RFI/RI report, the objective cannot be considered to be fully met.

Objective 17 Conduct a baseline risk assessment

This objective was partially met as a BRA composed of both an EE and a PHE was completed However neither of these studies was presented in a manner that allowed for a complete review For the EE the data were not presented in a manner that allowed for verification. Therefore the conclusions of this EE cannot be substantiated For the PHE the overall quality was poor Again the lack of structure and organization of the PHE prevented a detailed review Although the necessary information may be scattered throughout the document, it is difficult to locate and extract. In many instances the reader is forced to make assumptions based on incomplete information. In other cases the pertinent data should be backcalculated from appendices or attachments It was time-consuming and exhaustive to evaluate the risk assessment, which would not have been necessary if the BRA had followed RAGS (EPA 1989) more closely and used the examples presented in the guidance Instead the PHE focuses on many time- and labor-consuming issues that are unnecessary or irrelevant to a BRA Predominant among the unnecessary components was the use of Monte Carlo or Latin Hypercube simulations Although this methodology can be a powerful risk assessment tool it can be misused and distort the overall perception of risk associated with OU 1

The conclusions and results of the risk assessment could not be verified in the present state of the BRA Perhaps the calculations and conclusions could have been confirmed given much more time but the purpose of the BRA is to present the risks associated with exposure to contaminants in a clean and concise manner The PHE falls short of this goal and should be modified accordingly

Conclusion

As noted in the above assessment of this RFI/RI report s ability to meet the 17 objectives of the investigation the majority of the objectives were either not met or only partially met. PRC believes that rewriting the report using the recommendations made in the general and specific comments of this review will allow for most of the objectives to be met However the poor data presentation precluded a close scrutiny of some of the conclusions and calculations and additional comments may be generated when the data can be reviewed in a more logical format.

6 0 REFERENCES

American Conference of Governmental Industrial Hygienists Inc 1986 Documentation of the Threshold Limit Values and Biological Exposure Indices Fifth Edition Cincinnati Ohio

CDH 1992 Rocky Flats History Rocky Flats Toxicological Review and Dose Reconstruction Task 3/4 February 1992

DOE 1991 Phase III RFI/RI Operable Unit 1 881 Hillside Environmental Evaluation Fields Sampling Plan U S Department of Energy Rocky Flats Plant, Golden Colorado November 1991

DOE 1992a. Final Interim Measure/Interim Remedial Action French Drain Performance Monitoring Plan Rocky Flats Plant 881 Hillside Area (Operable Unit No 1) U S Department of Energy Environmental Restoration Program Rocky Flats Plant, Golden, Colorado June 8 1992

DOE 1992b Draft Technical Memorandum 5 Addendum to Final Phase III RFI/RI work plan U S Department of Energy Rocky Flats Plant, Golden Colorado January 1992

Driscoll F G 1986 Groundwater and Wells 2nd edition Johnsen Division, St. Paul Minnesota, 1986

EG&G 1990 General Radiochemistry and Routine Analytical Services Protocol EG&G Rocky Flats Environmental Restoration Program September 1990

EPA 1988 Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA Interim Final EPA/540/G 89/004 OSWER Directive 9355 3 01 October 1988

EPA 1989 U S Environmental Protection Agency Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (Part A) Interim Final EPA/540/1 89/002 December 1989

EPA 1992a U S Environmental Protection Agency 1990 Integrated Risk Information Systemm (IRIS) Chemical Files Office of Health and Environmental Assessment, Office of Research and Development Washington D C

EPA 1992b U S Environmental Protection Agency 1990 Health Effects Assessment Summary Tables (HEAST) OERR 9200 6-303 (92 1) Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office Cincinnati Ohio

Richard F C and Bourg C M 1991 Aqueous Geochemistry of Chromium A Review Water Research v 23 no 7 pp 807 816

Weast R C (ed) 1979 Handbook of Chemistry and Physics CRC Press Inc Cleveland Ohio

REMEDIAL INVESTIGATION REPORT
CHEMICALS DETECTED IN SITE 2 SOIL (0 2 feet)

Chemical	Sample Quantitation Limit	CRQL	Frequency of Detection (Detects/No Samples)	Minimum Concentration	Maximum Concentration	Average Concentration	95% Upper Confidence Limit
Metals (mg/kg)							
Aluminum	NA	20.0	8/8	6060.0	26100.0	18110.0	22[illegible]63.3
Arsenic	NA	1.0	8/8	6.2	49.2	24.5	33.7
Barium	NA	20.0	8/8	43.8	204.0	136.0	172.0
Beryllium	0.15 0.58	0.5	2/8	1.6	1.7	0.6	1.0
Cadmium	0.36 0.46	0.5	2/8	0.4	1.0	0.3	0.5
Calcium	NA	500.0	8/8	2890.0	10500.0	6731.3	8401.0
Chromium	NA	1.0	8/8	10.1	97.7	65.6	8[illegible].6
Cobalt	NA	5.0	8/8	4.9	19.7	14.3	17.7
Copper	NA	[illegible].5	8/8	7.1	42.7	2[illegible].3	37.6
Iron	NA	10.0	8/8	8350.0	65900.0	34056.3	48121.5
Lead	NA	0.3	8/8	3.5	33.7	16.1	22.1
Magnesium	NA	500.0	8/8	2640.0	21200.0	14180.0	18573.4
Manganese	NA	1.5	8/8	128.0	518.0	395.6	493.1
Nickel	NA	1.0	8/8	13.0	139.0	88.2	117.7
Potassium	NA	500.0	8/8	1180.0	4140.0	3103.8	3760.0
Selenium	0.11 0.36	0.5	2/8	0.7	0.8	0.3	0.5
Silver	0.29 2.4	1.0	8/8	0.4	0.4	0.5	0.8
Sodium	NA	500.0	8/8	218.0	990.0	605.8	788.2
Thallium	0.1[illegible] 4.0	1.0	1/8	0.3	0.3	0.6	1.1
Vanadium	NA	5.0	8/8	21.2	75.3	53.8	65.4
Zinc	NA	[illegible].0	8/8	29.0	209.0	88.2	121.9

Sample Table referred to on
page 30 comment #1